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Han et al.

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(54) **BUSH BEARING FABRICATING METHOD THEREOF AND HERMETIC COMPRESSOR HAVING THE SAME**

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(21) Appl. No.: **13/149,255**

(22) Filed: **May 31, 2011**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

F04B 39/00	(2006.01)
F04B 39/12	(2006.01)
F16C 9/02	(2006.01)
F16C 33/20	(2006.01)

(52) **U.S. Cl.**

CPC ***F04B 39/0094*** (2013.01); *F04C 2240/56* (2013.01); ***F04B 39/121*** (2013.01); *F16C 2223/32* (2013.01); ***F16C 9/02*** (2013.01); ***F16C 33/208*** (2013.01); *F16C 2208/32* (2013.01)

(58) **Field of Classification Search**

CPC F04C 23/008; F04C 2240/50; Y10S 417/902; F16C 33/208

USPC 417/410.1, 902; 384/160, 213; 29/898, 29/898.04, 898.06, 898.061, 898.13, 29/898.15

See application file for complete search history.

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(57) **ABSTRACT**

Disclosed are a bush bearing, a fabricating method thereof and a hermetic compressor having the same. A lubricant member of the bush bearing can be adhered onto a housing or press-fitted therein so as to remarkably increase the thickness of the lubricant member, whereby the bush bearing can be more resistant to abrasion, and upon applying the same to the compressor, abrasion of a crank shaft or the bush bearing can be reduced.

12 Claims, 10 Drawing Sheets

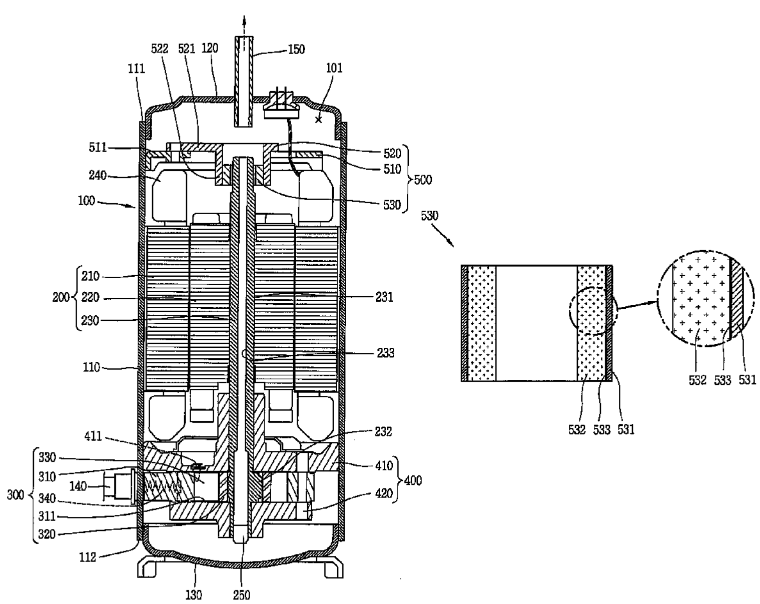


FIG. 1

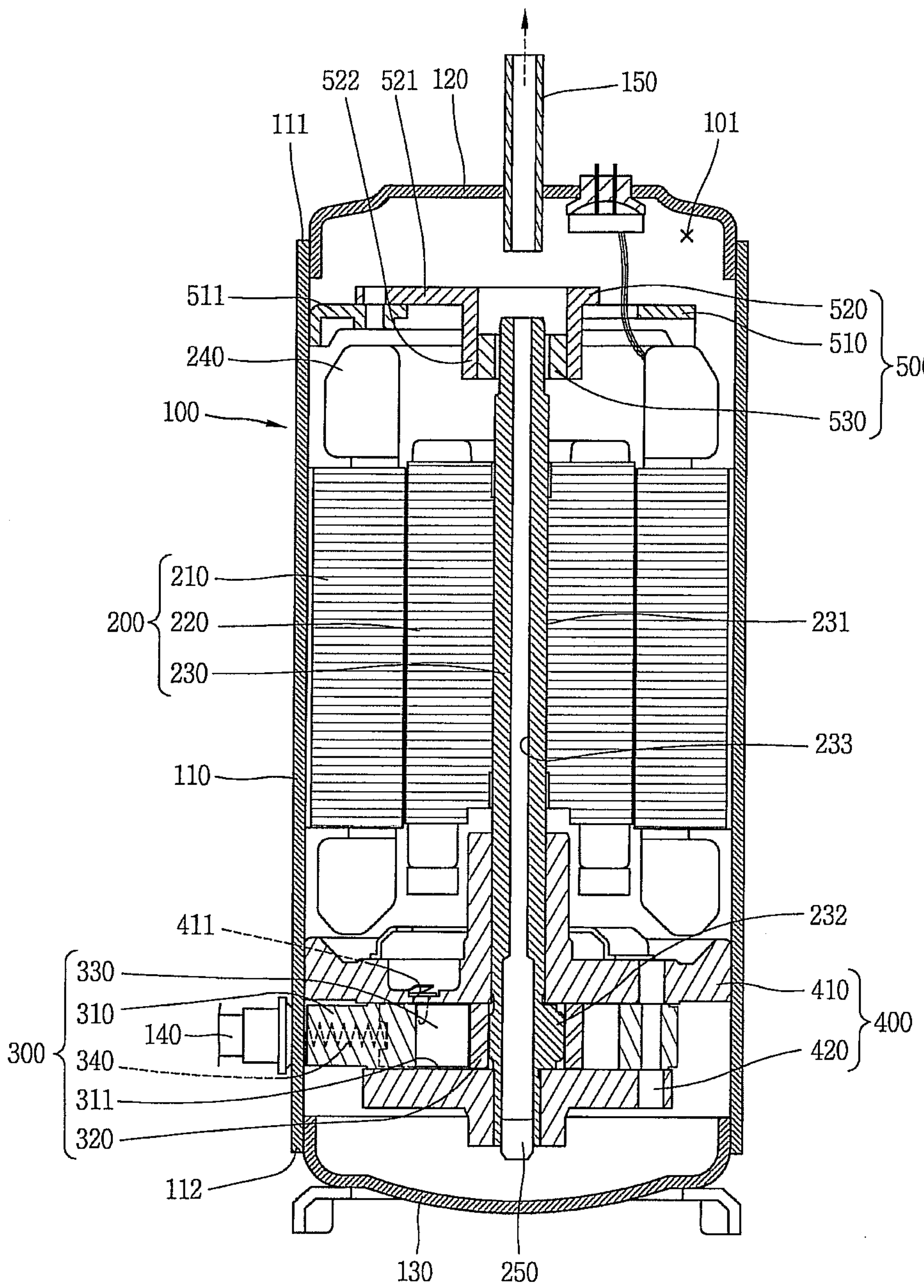

522
521
120
150
111
101
511
520
510
500
240
530
100
210
200
220
231
230
233
110
232
411
330
410
310
400
140
300
340
420
311
320
112
130
250

FIG. 2

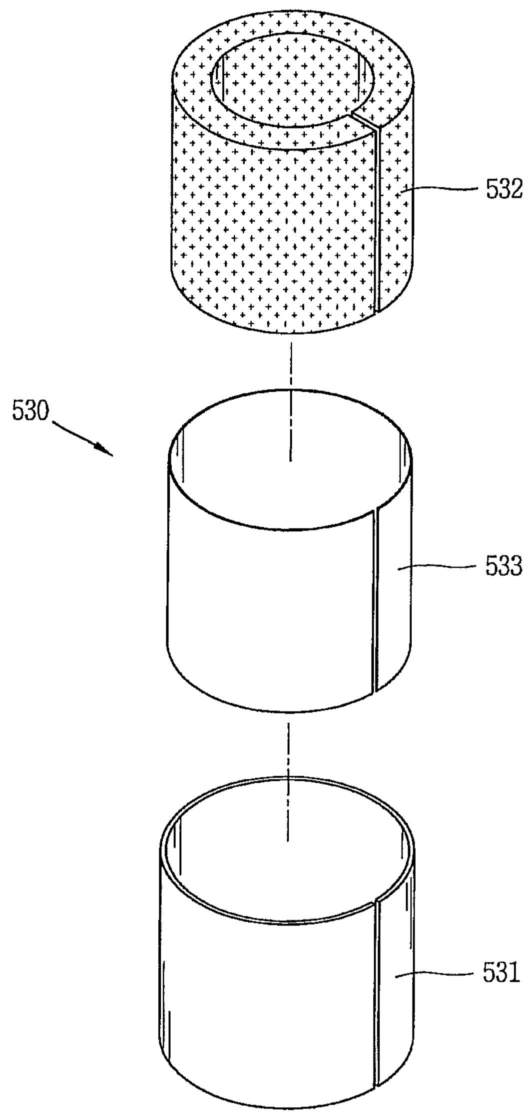


FIG. 3

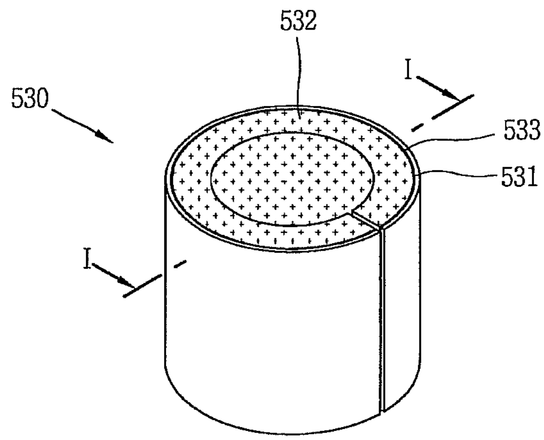


FIG. 4

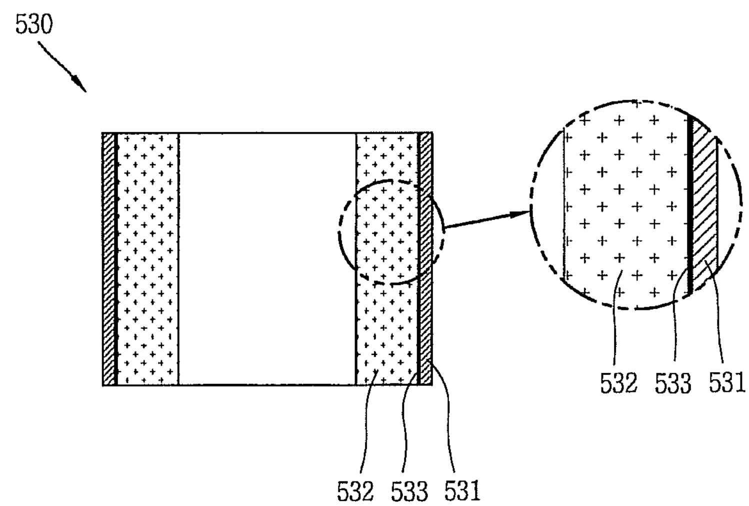


FIG. 5

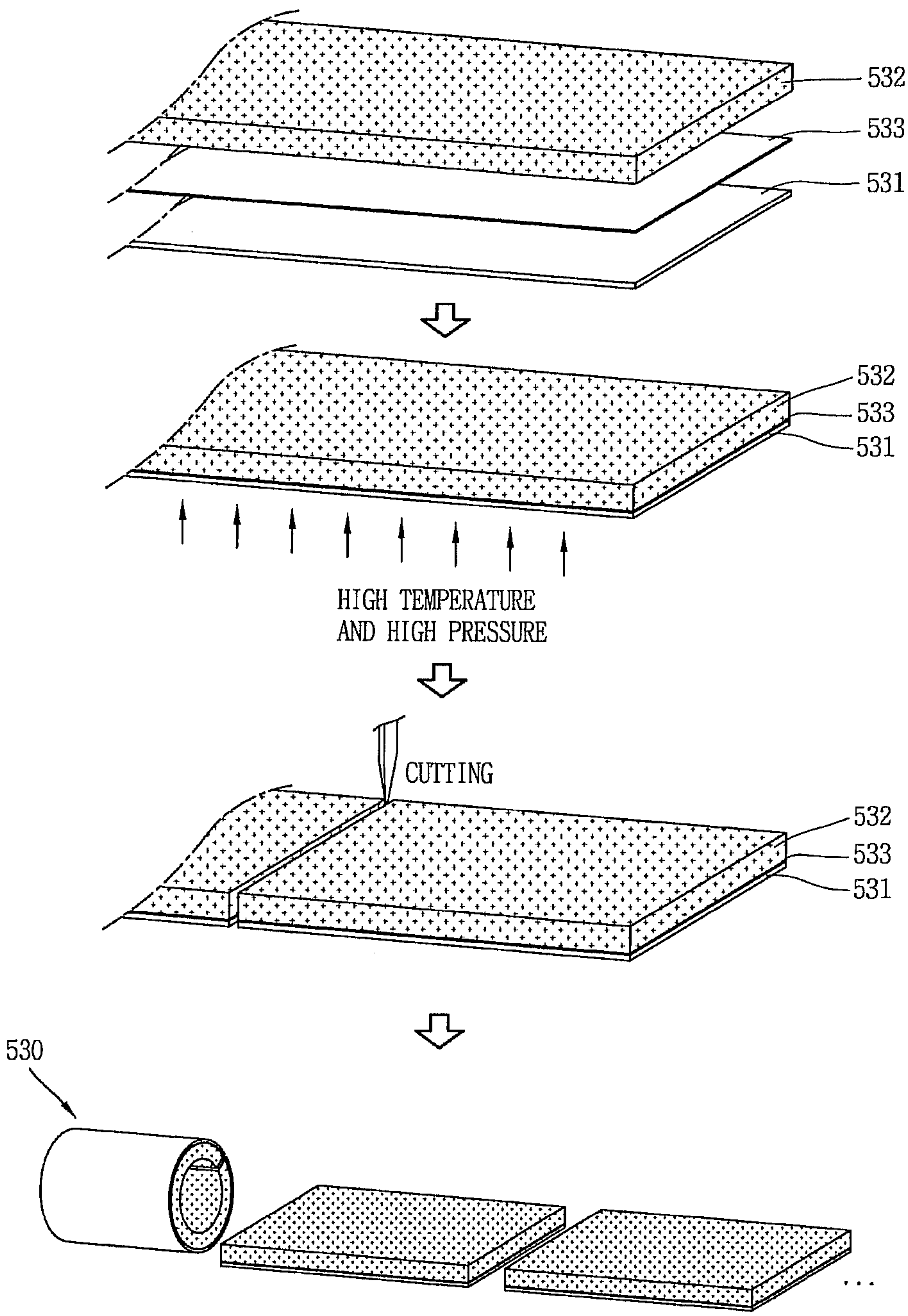

532
533
531
532
533
531
HIGH TEMPERATURE
AND HIGH PRESSURE
CUTTING
532
533
531
530
...

FIG. 6

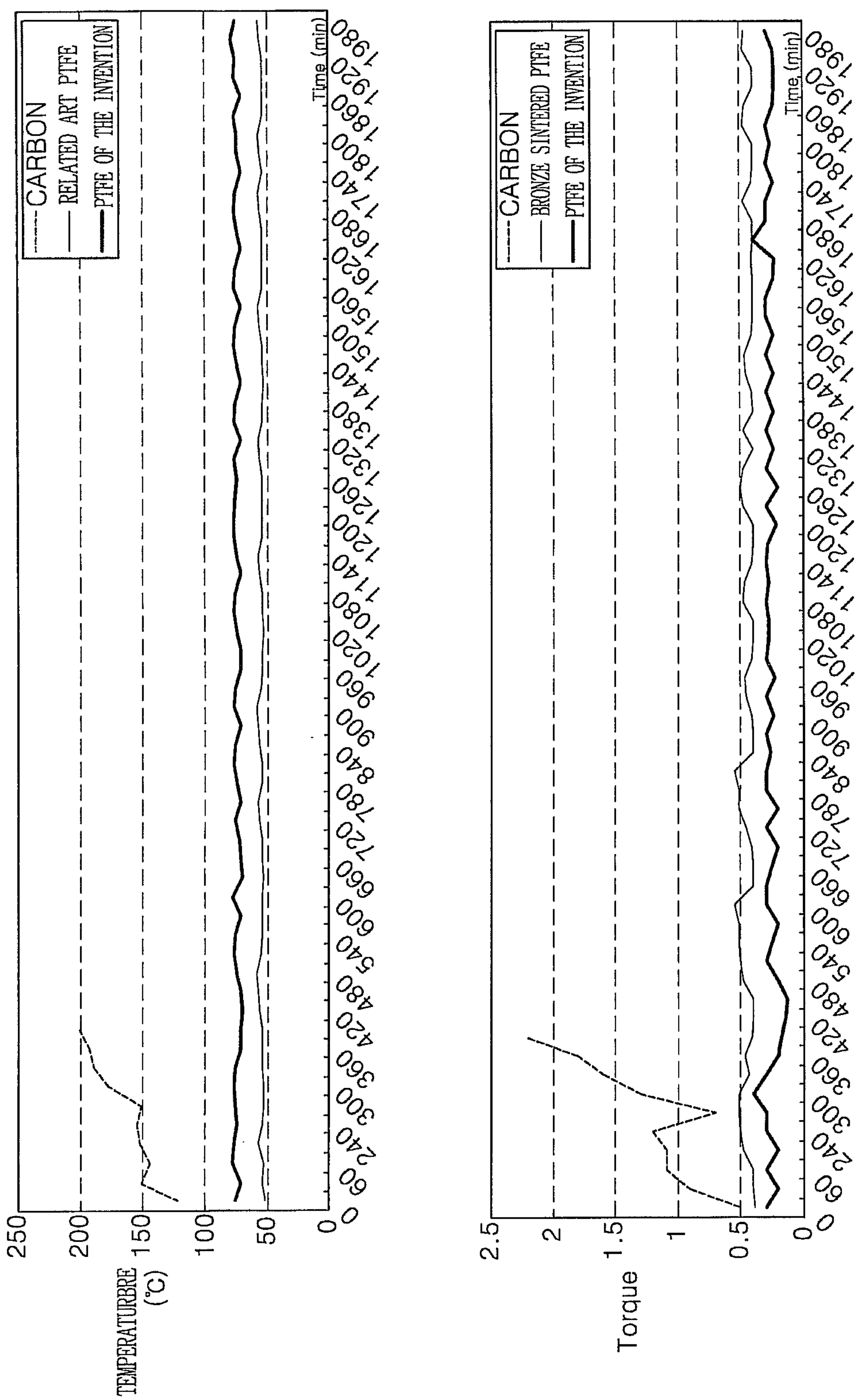

CARBON
RELATED ART PTFE
PTFE OF THE INVENTION
TEMPERATURBRE (°C)
250
200
150
100
50
0
Time (min)
0
60
240
300
360
420
480
540
600
660
720
780
840
900
960
1020
1080
1140
1200
1260
1320
1380
1440
1500
1560
1620
1680
1740
1800
1860
1920
1980
CARBON
BRONZE SINTERED PTFE
PTFE OF THE INVENTION
Torque
2.5
2
1.5
1
0.5
0
Time (min)

FIG. 7

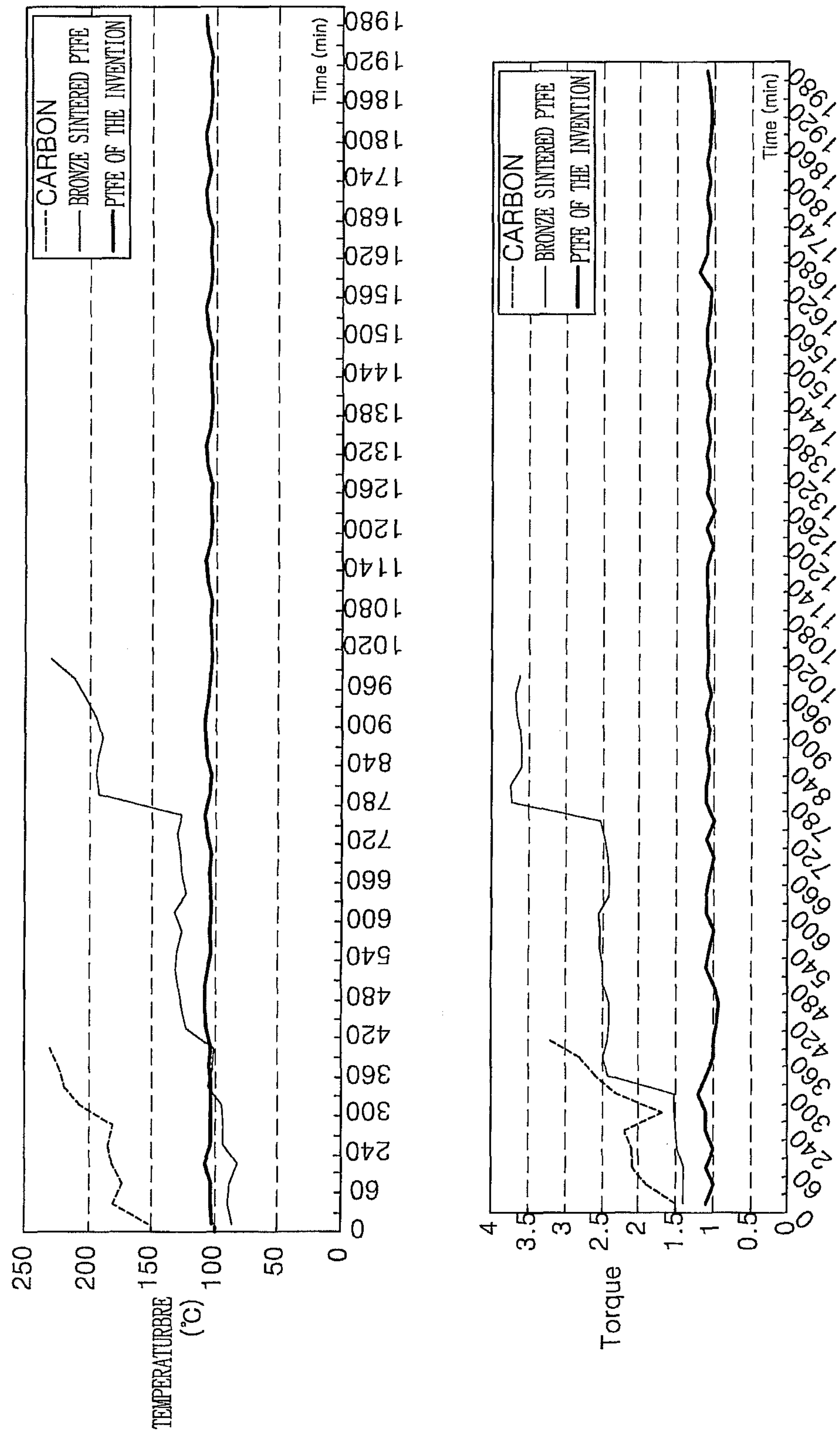

CARBON
BRONZE SINTERED PTFE
PTFE OF THE INVENTION
TEMPERATURBRE (℃)
Time (min)
Torque

FIG. 8

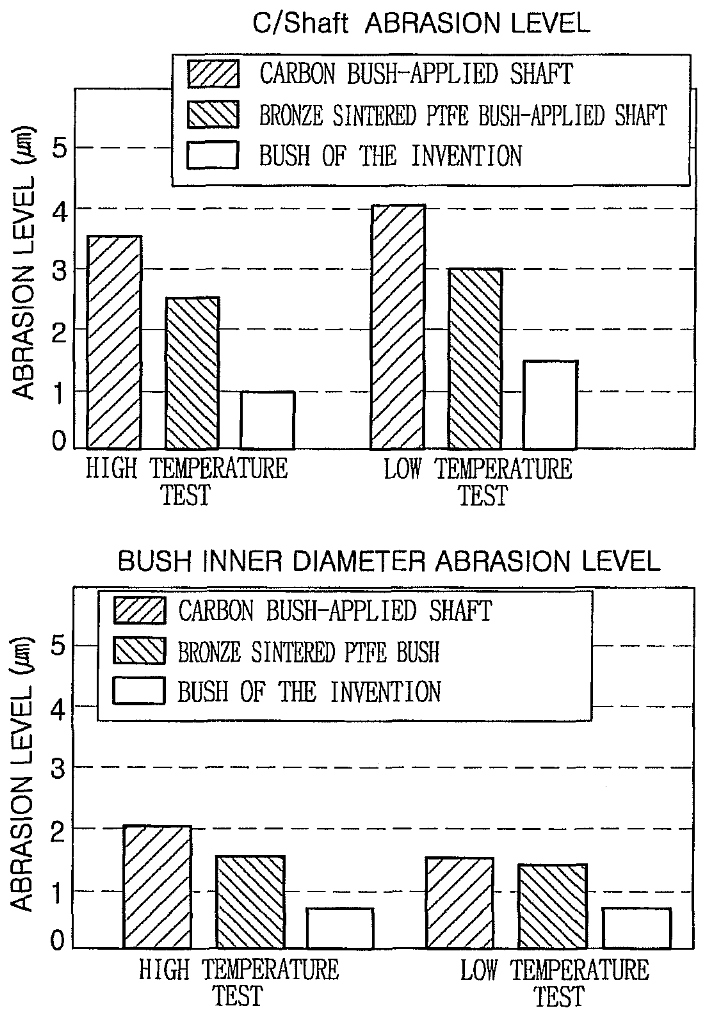
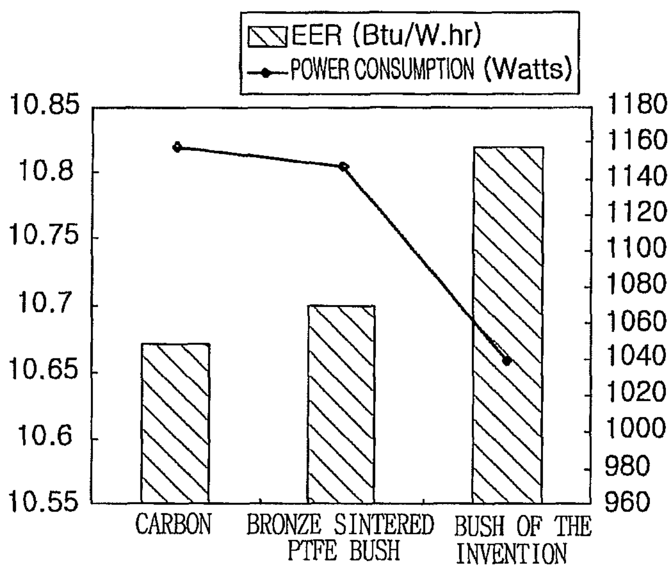

C/Shaft ABRASION LEVEL
CARBON BUSH-APPLIED SHAFT
BRONZE SINTERED PTFE BUSH-APPLIED SHAFT
BUSH OF THE INVENTION
ABRASION LEVEL (μm)
0
1
2
3
4
5
HIGH TEMPERATURE TEST
LOW TEMPERATURE TEST
BUSH INNER DIAMETER ABRASION LEVEL
CARBON BUSH-APPLIED SHAFT
BRONZE SINTERED PTFE BUSH
BUSH OF THE INVENTION
ABRASION LEVEL (μm)
0
1
2
3
4
5
HIGH TEMPERATURE TEST
LOW TEMPERATURE TEST

FIG. 9



EER (Btu/W.hr)
POWER CONSUMPTION (Watts)
10.85
10.8
10.75
10.7
10.65
10.6
10.55
1180
1160
1140
1120
1100
1080
1060
1040
1020
1000
980
960
CARBON
BRONZE SINTERED PTFE BUSH
BUSH OF THE INVENTION

FIG. 10

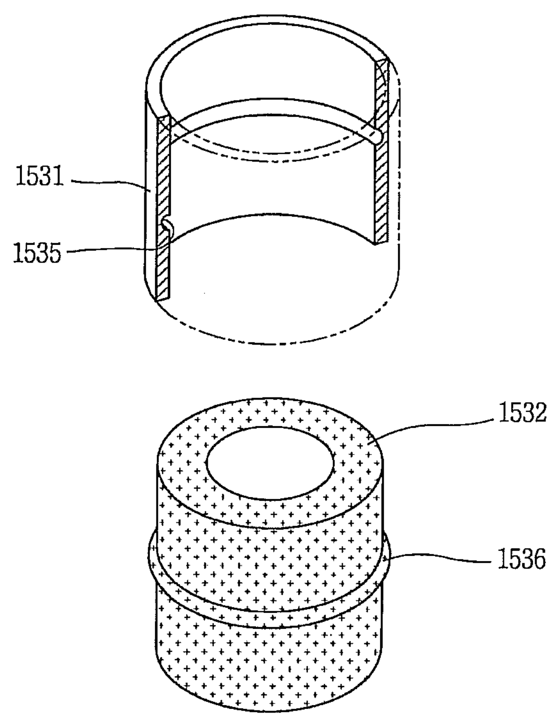
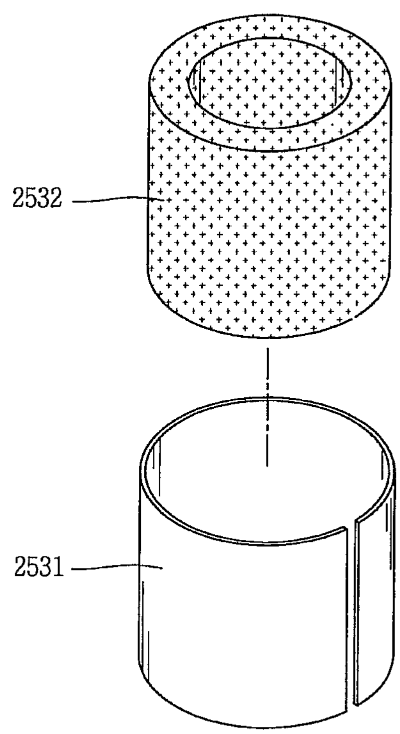


FIG. 11



BUSH BEARING FABRICATING METHOD THEREOF AND HERMETIC COMPRESSOR HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

Pursuant to 35 U.S.C. §119(a), this application claims the benefit of earlier filing date and right of priority to Korean Application No. 10-2010-0071627, filed on Jul. 23, 2010, the contents of which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This specification relates to a bush bearing used as a journal bearing and a hermetic compressor having the same.

2. Background of the Invention

In general, a hermetic compressor includes a motor for generating a driving force in an inner space of a hermetic case, and a compression part coupled to the motor for compressing a refrigerant. The hermetic compressors may be divided into a reciprocal type, a scroll type, a rotary type, a vibration type and the like according to a refrigerant compression mechanism. The reciprocal type, the scroll type and the rotary type use a rotational force of the motor, while the vibration type uses a reciprocal motion of the motor part.

Among those hermetic compressors, the motor of the hermetic compressor using the rotational force has a crank shaft to transfer the rotational force of the motor to the compression part. For example, the motor of the rotary type hermetic compressor (hereinafter, referred to as a rotary compressor) includes a stator fixed to the hermetic case, a rotor inserted in the stator with a predetermined gap therebetween to be rotatable by interaction with the stator, and a crank shaft coupled to the rotor to transfer the rotational force of the rotor to the compression part.

The compression part includes a cylinder, a rolling piston and a vane for compressing a refrigerant in the cylinder, and a plurality of bearing members for defining a compression space together with the cylinder and supporting the crank shaft. The bearing members are typically located at one side of the motor to support the crank shaft. However, as compressors becomes highly efficient in recent time, a technology of minimizing compressor vibration by installing bearings at both upper and lower ends of the crank shaft has been introduced.

When the bearings are installed at the upper and lower ends of the crank shaft, the upper bearing may generally be implemented as a ball bearing or a bush bearing. Especially, the bush bearing may be made of bimetal, resin (polytetrafluoroethylene (PTFE), typically Teflon), carbon, a solid material and the like. Among others, bimetal, resin and carbon are generally used for a compressor, and the resin-based bush bearing is used the most widely. A bush bearing made of bimetal or carbon is highly resistant to abrasion, and a bush bearing made of resin is excellent in view of a frictional loss due to a low frictional coefficient of the resin.

However, in the configuration of the related art Teflon-based bush bearing, since the Teflon having lubricity is pressed-fitted between porous bronze sintered layers, the Teflon layer is actually formed with a thickness of approximately 20 μm, which is merely as thin as about 20% of the overall thickness of the bush bearing. Consequently, if a friction is generated between an outer circumferential surface of the crank shaft and an inner circumferential surface of the bush bearing, the Teflon layer of the bush bearing may be fast worn away and thereby the metallic bronze sintered layer may come in contact with the crank shaft, resulting in a drastic abrasion of the bush bearing or the crank shaft.

SUMMARY OF THE INVENTION

Therefore, an aspect of the detailed description is to provide a bush bearing, capable of reducing a frictional loss by way of increasing a thickness of a Teflon layer without increase in the thickness of the bush bearing, in a Teflon-based bush bearing, a fabrication method thereof, and a hermetic compressor having the same.

To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, a bush bearing including a housing, a lubricant member fixed to an inner circumferential surface of the housing and having a bearing surface such that a rotating element is inserted therein, wherein the lubricant member is made of a resin based type.

In another aspect, there is provided a bush bearing including a housing, a lubricant member fixed to an inner circumferential surface of the housing and having a bearing surface such that a rotating element is inserted therein, and an adhesive member interposed between the housing and the lubricant member and configured to allow adhesion of the lubricant member onto the housing.

In one aspect, there is provided a method for fabricating a bush bearing including coating an adhesive on a steel sheet having a plate shape, coating a resin material having a plate shape on the adhesive, melting the adhesive at high temperature and high pressure such that the resin material is adhered onto the steel sheet, and rolling the resin material-adhered steel sheet and cutting the same or cutting the resin material-adhered steel sheet and rolling the same.

In one aspect, there is provided a hermetic compressor including a hermetic case, a stator fixed to an inner space of the hermetic case, a rotor rotatably disposed with respect to the stator, a crank shaft coupled to the rotor, a compression part coupled to the crank shaft to compress a refrigerant, a first bearing coupled to the compression part to support a first portion of the crank shaft, and a second bearing fixed to the hermetic case to support a second portion of the crank shaft, wherein the second bearing includes a bush bearing, wherein the bush bearing includes a housing, and a lubricant member fixed to an inner circumferential surface of the housing and slidably inserted in the second portion of the crank shaft, the lubricant member being more flexible than a material of the crank shaft.

Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. **1** is a longitudinal sectional view showing an inner structure of a rotary compressor in accordance with an exemplary embodiment;

FIG. **2** is a disassembled perspective view showing an exemplary embodiment of a bush bearing;

FIG. **3** is an assembled perspective view of the bush bearing shown in FIG. **2**;

FIG. **4** is an assembled sectional view of the bush bearing shown in FIG. **3**;

FIG. **5** is a perspective view showing a process of fabricating the bush bearing shown in FIG. **2**;

FIG. **6** is a graph showing results of abrasion resistance test in an oil-fed state;

FIG. **7** is a graph showing results of abrasion resistance test in an oilless state;

FIG. **8** is a graph showing testing results of abrasion levels of the crank shaft and the bush bearing in case where the bush bearing is applied as a second bearing of the rotary compressor;

FIG. **9** is a graph showing results of performance variation of the rotary compressor in case where the bush bearing is applied as a second bearing of the rotary compressor; and

FIGS. **10** and **11** are disassembled perspective views respectively showing another exemplary embodiments of the bush bearing shown in FIG. **1**.

DETAILED DESCRIPTION OF THE INVENTION

Description will now be given in detail of a bush bearing, and a hermetic compressor according to the exemplary embodiments, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numbers, and description thereof will not be repeated.

As shown in FIG. **1**, a rotary compressor may include may include a motor **200** located at an upper side of an inner space **101** of a hermetic case **100** for generating a driving force, a compression part **300** located at a lower side of the inner space **101** of the hermetic case **100** for compressing a refrigerant using the driving force generated from the motor **200**, and a first bearing **400** and a second bearing **500** installed at lower and upper sides of the motor **200** for supporting a first portion and a second portion of a crank shaft **230**, respectively, which will be explained later.

The hermetic case **100** may include a case main body **110** having the motor **200** and the compression part **300** installed therein, an upper cap (hereinafter, referred to as a first cap) **120** for covering an upper open end (hereinafter, referred to as a first opening) **111** of the case main body **110**, and a lower cap (hereinafter, referred to as a second cap) **130** for covering a lower open end (hereinafter, referred to as a second open end) **112** of the case main body **110**.

The case main body **110** may have a cylindrical shape. A suction pipe **140** may be penetratingly coupled to a principal surface of a lower side of the case main body **110**. The suction pipe **140** may be directly connected to an inlet (not shown) located at a cylinder **310**, which will be explained later.

An edge of the first cap **120** may be bent to be welded to the first opening **111** of the case main body **110**. A discharge pipe **150** for guiding a refrigerant discharged from the compression part **300** into the inner space **101** of the hermetic case **100** to a refrigeration cycle may be penetratingly coupled to the center of the first cap **120**.

A edge of the second cap **130** may be bent to be welded to the second opening **112** of the case main body **110**.

The motor **200** may include a stator **210** shrink-fitted to an inner circumferential surface of the hermetic case **100**, a rotor **220** disposed inside the stator **210** to be rotatable with respect to the stator **210**, and a crank shaft **230** shrink-fitted to the rotor **220** and thusly rotating together with the rotor **220** so as to transfer a rotational force of the motor **200** to the compression part **300**.

The stator **210** may be formed by laminating a plurality of stator sheets by a predetermined height, and teeth disposed along its inner circumferential surface may be wound with a coil **240**.

The rotor **220** may be located at the inner circumferential surface of the stator **210** with a predetermined gap therebetween, and the crank shaft **230** may be shrink-fitted in the center of the rotor **220** to be integrally coupled to the rotor **220**.

The crank shaft **230** may include a shaft portion **231** coupled to the rotor **220**, and an eccentric portion **232** eccentrically formed at a lower end of the shaft portion **231** and coupled with a rolling piston **320**, which will be explained later. The shaft portion **231** may include a first portion (reference numeral not given) formed at a lower side of the eccentric portion **232** to be supported by the first bearing **400**, and a second portion (reference numeral not given) formed at an upper side of the eccentric portion **232** to be supported by the second bearing **500**. An oil passage **233**, through which oil within the hermetic case **100** is sucked up, may be formed through the crank shaft **230** in an axial direction.

The compression part **300** may include a cylinder **310** installed in the hermetic case **100**, a rolling piston **320** rotatably coupled to the eccentric portion **232** of the crank shaft **230** for compressing a refrigerant with orbiting in a compression space of the cylinder **310**, a vane **330** movably coupled to the cylinder **310** in a radial direction such that a sealing surface of one side thereof contacts an outer circumferential surface of the rolling piston **320** to partition the compression space of the cylinder **310** into a suction chamber and a discharge chamber, and a vane spring **340** implemented as a compression spring for elastically supporting the rear side of the vane **330**.

The cylinder **310** may have an annular shape. An inlet (not shown) connected to the suction pipe **140** may be formed at one side of the cylinder **310**, and a vane slot **311**, into which the vane **330** is slid, may be formed at one side of the inlet in a circumferential direction. A discharge guiding groove (not shown), which communicates with an outlet **411** located at an upper bearing **410** to be explained later, may be formed at one side of the vane slot **311** in a circumferential direction.

The first bearing **400** may include an upper bearing **410** for cover the upper side of the cylinder **310** and simultaneously supporting the crank shaft **230** in an axial direction and a radial direction by being welded to the hermetic case **100**, and a lower bearing **420** for covering the lower side of the cylinder **310** to support the crank shaft **230** in the axial direction and the radial direction.

The second bearing **500** may include a first frame **510** welded onto the inner circumferential surface of the hermetic case **100** above the stator **210**, and a second frame **520** coupled to the frame **510** so as to be rotatably coupled to the crank shaft **230**.

The frame **510** may be formed in an annular shape, and have fixing protrusions **511** protruding from an outer circumferential surface thereof by predetermined lengths to be welded onto the case main body **110**. The fixing protrusions **511** may have an approximately 120° interval from one another along a circumferential direction.

The second frame **520** may include support protrusions **521** with an approximately 120° interval from one another so as to be supported at three points of the first frame **510**. A bearing protrusion **522** may downwardly protrude from the center of the housing **520**, such that an upper end of the crank shaft **230** can be inserted therein to be supported. A bearing bush **530** may be coupled to the bearing protrusion **522**.

An unexplained reference numeral **250** denotes an oil feeder.

The rotary compressor having such configuration will operate as follows.

That is, when power is applied to the stator **210** of the motor **200** to rotate the rotor **220**, the crank shaft **230** rotates with both ends thereof being supported by the first bearing **400** and the second bearing **500**. The crank shaft **230** thus transfers a rotational force of the motor **200** to the compression part **300**. The rolling piston **320** in the compression part **300** then eccentrically rotates in the compression space. Accordingly, the vane **330** forms a compression space together with the rolling piston **320** to compress a refrigerant. The compressed refrigerant is then discharged into the inner space **101** of the hermetic case **100**.

Here, the crank shaft **230** fast rotates such that the oil feeder **250** located below the crank shaft **230** pumps up oil contained in an oil storage of the hermetic case **100**. The oil is then sucked up via the oil passage **233** of the crank shaft **230** to lubricate each bearing surface.

However, the second bearing **500** is implemented as the bush bearing, but the bush bearing has a lubricant layer made of resin, such as Teflon, inside a porous bronze sintered layer, which may cause the lubricant layer to be as thin as about 20 μm. Accordingly, upon rotation of the crank shaft **230**, the lubricant layer may be fast worn away, and thereby a metallic bronze sintered layer may be appeared, thereby possibly causing abrasion against the crank shaft **230**. Hence, this specification purposes to delay abrasion of the lubricant layer by increasing the thickness of the lubricant layer.

FIG. **2** is a disassembled perspective view showing an example of a bush bearing, FIG. **3** is an assembled perspective view of the bush bearing shown in FIG. **2**, and FIG. **4** is an assembled sectional view of the bush bearing shown in FIG. **3**.

As shown in FIGS. **2** to **4**, the bush bearing **530** may be configured that a lubricant member **532**, such as Teflon, is adhered into a housing **531**, which is fixedly inserted in the bearing protrusion **522**, by virtue of an adhesive film **533** as an adhesive member.

The housing **531** may be formed using a cold rolled carbon steel sheet having predetermined rigidity and thickness by rolling it in an arcuate shape, and the lubricant member **532** may have the same arcuate section as that of the housing **531**. The thickness of the lubricant member **532** may increase much thicker than that of the related art one. For example, if the related art lubricant member is approximately 20 μm thick, the lubricant member **532** of this specification may be approximately 200 μm thick by increasing as much as the thickness of a bronze sintered layer excluded. Here, the adhesive film **533** may form an extremely thin layer.

A process of fabricating the bush bearing will be explained hereinafter.

As shown in FIG. **5**, the adhesive film **533** having a plate shape may be coated on the housing (steel sheet) **531** in a flat plate shape. A resin material (hereinafter, described with the same number as the lubricant member **532**) in a plate shape, which may act as the lubricant member **532**, may be laid on the adhesive film **533**.

High temperature and high pressure may then be applied to the steel sheet **531** to melt the adhesive film **533**, thereby allowing adhesion of the resin material **532** onto the steel sheet **531**.

The resin material-adhered steel sheet **531** may then be rolled and cut, or cut into a particular size to be rolled into a cylindrical shape as shown in the drawing.

Hereinafter, description will be given of an operational effect of the bush bearing having such structure.

That is, as the lubricant member **532** of the bush bearing **530** is adhered onto the housing **531** to be coupled thereto, the lubricant member **532** can be approximately 10 times thicker than that of the related art one. Consequently, the bush bearing **530** can be more resistant to abrasion. Also, upon applying the bush bearing to a compressor, abrasion of the crank shaft **230** or the bush bearing **530** can be reduced. Such abrasion levels have been tested and thusly-obtained results are shown in FIGS. **6** to **9**.

FIG. **6** shows the results of abrasion resistance test in an oil-fed state, and FIG. **7** shows the results of abrasion resistance test in an oilless state. Referring to those graphs, it can be noticed that temperature and torque between the bush bearing **530** and the crank shaft **530** during operation thereof are considerably lower than those of the carbon-based bush bearing or the Teflon-based bush bearing having the bronze sintered layer according to the related art. Hence, it can be understood that the bush bearing of this specification has an improved abrasion resistance as compared with the related art bush bearing.

FIG. **8** shows testing results of abrasion levels of the crank shaft and the bush bearing in case where the bush bearing is applied as a second bearing of the rotary compressor. As shown in FIG. **8**, it can be observed that the abrasion levels of the crank shaft and the bush bearing are considerably low as compared with that of the related art carbon-based bush bearing or Teflon-based bush bearing having the bronze sintered layer.

FIG. **9** is a graph showing results of performance variation of the rotary compressor in case where the bush bearing in case where the bush bearing is applied as a second bearing of the rotary compressor.

As shown in FIG. **9**, it can be observed that performance and power consumption of the rotary compressor having the bush bearing according to this specification are remarkably improved as compared with those of the rotary compressor having the related art bush bearing.

Hereinafter, description will be given of other embodiments of the bush bearing.

That is, the foregoing embodiment exemplarily illustrates that the housing and the lubricant member are coupled by virtue of the adhesive member. However, this exemplary embodiment illustrates that a housing **1531** is formed in a cylindrical shape, and a lubricant member **1532** also having a cylindrical shape is press-fitted into the housing **1531**.

Here, a fixing groove **1535** may be formed at an inner circumferential surface of the housing **1531** and a fixing protrusion **1536** may be formed at an outer circumferential surface of the lubricant member **1532** to be engaged with the fixing groove **1535**. Accordingly, the fixing protrusion **1536** of the lubricant member **1532** can be inserted in the fixing groove **1535** of the housing **1531**, thereby improving an adhesion force therebetween. Alternatively, the fixing protrusion **1536** may be formed at the inner circumferential surface of the housing **1531**, and the fixing groove **1536** may be formed at the outer circumferential surface of the lubricant member **1532**.

Also, instead of previously forming the fixing groove **1535** and the fixing protrusion **1536**, in a state that the lubricant member **1532** is press-fitted into the housing **1531**, at least one portion on the outer circumferential surface of the housing **1531** may be pressed in a radial direction such that the housing **1531** can be dented toward the lubricant member **1532**, thereby forming the fixing groove and the fixing protrusion.

In addition, as shown in FIG. **11**, a housing **2531** may be formed with an arcuate section and a lubricant member **2532** may be formed with a cylindrical section. Then, the lubricant member **2532** can be press-fitted into the housing **2531**. Here, the housing **2531** may act as a snap ring having elasticity so as to further improve an adhesive force with the lubricant member **2532**. Alternatively, the lubricant member may have the arcuate sectional shape and the housing may have the cylindrical sectional shape. Here, an outer diameter of the lubricant member may be slightly greater than an inner diameter of the housing such that the lubricant member can be astringed and then relaxed in the housing, thereby improving the adhesion force between the housing and the lubricant member.

The basic operational effects of the bush bearings according to the above exemplary embodiments are similar or the same as the foregoing embodiment, and thus detailed description thereof will not be repeated.

The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A hermetic compressor comprising:
- a hermetic case;
- a motor including a stator attached to an inner space of the hermetic case, a rotor rotatably provided with respect to the stator, and a crank shaft coupled to the rotor;
- a compression part coupled to the crank shaft to compress a refrigerant based on driving force of the motor;
- a first bearing to support a first portion of the crank shaft; and
- a second bearing to support a second portion of the crank shaft,
- wherein the second bearing includes:
  - a bush bearing,
  - a first frame formed in an annular shape, and the first frame having fixing protrusions protruding from an outer circumferential surface thereof by lengths to be welded onto an inner circumferential surface of the hermetic case, and
  - a second frame detachably coupled to the first frame and coupled with the bush bearing, the second frame includes a plurality of support protrusions supported by the first frame and a bearing protrusion that protrudes from the support protrusions toward the motor.

2. The compressor of claim **1**, wherein the bush bearing is coupled to the bearing protrusion such that the bush bearing is provided between the crank shaft and the bearing protrusion.

3. A hermetic compressor comprising:
- a hermetic case;
- a stator attached to an inner space of the hermetic case;
- a rotor rotatably provided with respect to the stator;
- a crank shaft coupled to the rotor;
- a compression part coupled to the crank shaft to compress a refrigerant;
- a first bearing to support a first portion of the crank shaft; and
- a second bearing attached to the hermetic case to support a second portion of the crank shaft,
- wherein the second bearing includes:
  - a bush bearing,
  - a first frame formed in an annular shape, and the first frame having fixing protrusions protruding from an outer circumferential surface thereof by lengths to be welded onto an inner circumferential surface of the hermetic case, and
  - a second frame detachably coupled to the first frame and coupled with the bush bearing, the second frame includes a plurality of support protrusions supported by the first frame and a bearing protrusion that protrudes from the support protrusions toward the rotor, and
- wherein the bush bearing includes:
  - a housing, and
  - a lubricant member coupled to an inner surface of the housing and that slidably surrounds a portion of the crank shaft, the lubricant member being more flexible than the crank shaft,
  - wherein both the housing and the lubricant member have an annular section,
  - wherein a protrusion is formed on an outer surface of the lubricant member or the inner surface of the housing, and a groove is formed on the inner surface of the housing or the outer surface of the lubricant member such that the protrusion is provided within the groove, and
  - wherein the lubricant member is press-fitted into the housing.

4. The compressor of claim **3**, wherein the lubricant member includes a resin.

5. The compressor of claim **3**, further comprising an adhesive member between the housing and the lubricant member to provide adhesion between the housing and the lubricant member.

6. The compressor of claim **5**, wherein the lubricant member is thicker than the adhesive member.

7. The compressor of claim **5**, wherein the lubricant member includes the protrusion on an outer surface of the lubricant member, and the housing includes the groove on the inner surface of the housing such that the protrusion is provided with the groove.

8. The compressor of claim **3**, wherein the housing includes the protrusion on the inner surface of the housing, and the lubricant member includes the groove on the outer surface of the lubricant member such that the protrusion is provided within the groove.

9. The compressor of claim **3**, wherein the bush bearing is coupled to the bearing protrusion such that the bush bearing is provided between the crank shaft and the bearing protrusion.

10. The compressor of claim **1**, wherein the bush bearing includes:
- a housing;
- a lubricant member having a bearing surface to receive a rotating element; and

an adhesive member between the housing and the lubricant member to provide adhesion between the housing and the lubricant member;

wherein the housing and the lubricant member are made of different materials,

wherein the lubricant member is thicker than the housing, and

wherein the housing has an arcuate section and the lubricant member has an arcuate or a cylindrical section.

11. The compressor of claim **10**, wherein the lubricant member includes a protrusion on an outer surface of the lubricant member, and the housing includes a groove at the inner surface of the housing such that the protrusion is provided within the groove.

12. The compressor of claim **10**, wherein the housing includes a protrusion on the inner surface of the housing, and the lubricant member includes a groove on an outer surface of the lubricant member such that the protrusion is provided within the groove.

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